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SCIENCE IN MEDICAL EDUCATION[1]

By Dr. FREDERICK P. GAY

PROFESSOR OF BACTERIOLOGY, COLUMBIA UNIVERSITY

IT is not often, I imagine, that one who is privileged to address so large and representative an audience feels impelled to speak along the lines of his own most intimate concern and belief. I trust I may convince you that the history and atmosphere of this particular university community lends the most persuasive argument that could readily be found of the influence of the scientific aspects of medicine on medicine as a whole.

Medical science and its influence on the education of practitioners of medicine is naturally not fully understood by every one and indeed not always appreciated in some of its aspects by the medical profession at large. The public has heard that medicine as it is practised is some mysterious combination of art and science, embodied in a single individual who comes to their bedside in periods of dire emergency and who may, at happy intervals, seem to work miracles. The practitioner himself realizes that when he accomplishes such gratifying results it is through application of knowledge acquired from his predecessors, through personal experience, and, he should not hesitate to confess, at times through what appears to be the inspiration of emergency.

The wise physician, even more than the public, appreciates the present-day necessity of specialization within a complex field which no one man, however wide his interest and however unflagging his energy, can fully encompass. He knows, moreover, that the life work of certain of his colleagues, on whose collaboration he increasingly depends, lies outside the care of individual sufferers from disease. The laboratory man, as he is called, has become differentiated from the clinician or bedside physician as a natural corollary to accumulating knowledge and a division of labor. His particular activities have un-

[1] An address delivered at the 111th commencement of the George Washington University, June 15, 1932.

fortunately at times seemed remote and unrelated to the immediate concerns of practical medicine.

The Medical School of George Washington University has been in existence well over one hundred years and has faithfully served the main purpose for which it was created—namely, the training of able practitioners of the healing art. I have no question that, if I were better acquainted with your history, I could recall to your minds many noble and self-sacrificing physicians who have not only endeared themselves to this community but whose skill in diagnosis and treatment has been sought from afar. Fortunately, from my view-point, you enjoy what is to me a still greater distinction in that your school has been the fostering mother of that particular science in which I am most concerned. I venture to interpret your choice of the new leader who has recently come to guide and inspire your school of medicine, not entirely in terms of a glowing, lovable and energetic personality, nor yet as due to the advantage of his scientific training and accomplishment. The manifest destiny involved in your history prescribed that you must have chosen a bacteriologist. It needs, perhaps, some one from the outside fully to appreciate and to emphasize to you how much your university is involved in this new and important science which aims to interpret the significance of living, minute, extraneous agents in the production of disease.

Theobald Smith, Walter Reed, Frederick Russell! No other medical school in this country, and I venture to say in the world, can present a professorial sequence in bacteriology that equals it. They represented the birth, adolescence and young maturity of our science which reaches back only fifty odd years and whose life history almost exactly coincides with the tenure of the chair of bacteriology here by these three unusual men. During the twenty-four years between 1886 and 1910 Smith, Reed and Russell successively inspired your students of medicine through their knowledge and contributions in a field that was only then gaining proper recognition. I wish I might recite to you in detail the service these men have rendered medical science and the world, but it is familiar to all of you in its essence and to many of you in detail. Some of us might enter into friendly controversy at to whether Theobald Smith is responsible for five or several more fundamental discoveries in bacteriology, protozoology and immunity. I challenge you to find some one else since Pasteur and Koch who is universally credited with even the smaller number! Walter Reed told us in essence nearly all we know about yellow fever to-day, notably that its living agent or virus passes through filters that withhold the ordinary bacteria and that it is transmitted not through simple contact but by the bite of a special variety of mosquito. The latter observation in particular made avoidance of this dread disease possible through screening, and finally its eradication from whole localities certain if the insect transmitter were destroyed. Russell perfected and first employed typhoid vaccination on a large scale, and the accepted results of his work rendered the world war much less terrible in those armies that rigidly followed his method.

In a way the beginnings rather than the endings of discovery count most. It requires greater intellectual acumen to formulate principles than to apply them practically, because new principles represent radical departures from orthodox opinion, mean road-breaking through apparently impenetrable forests and involve the opening of new vistas. The first experiments that underlie great practical discoveries are often aimed to gratify pure intellectual curiosity rather than to attain results that are at first unperceived. Whether or not there be an "art for art's sake," there is indeed a "science for science's sake," which, in the last analysis, is that form of endeavor that is the most rewarding. Who can question the superiority of the mind that conceives the first experiment? Who would hesitate to place Faraday's discovery of the induction current of electricity about magnets a hundred years ago ahead of the invention of various forms of electric motors that now move the world, or of the loaded telephone wire which greatly amplifies its transmission of sound? These practical results, each in itself worthy of the greatest praise, are traced by their inventors to Faraday's initial and gratified curiosity.

You may recall that I neglected to specify the particular discoveries of Theobald Smith, to which I applied the term of "fundamental." It would take more time than I have at my disposal to explain in logical detail the importance of his recognition that the bacillus of cattle tuberculosis differs in certain unmistakable particulars from its relative that causes the same disease in man, a differentiation which alone is making it possible for us to arrive at a decision as to relative danger of milk from tuberculous cows and contact with tuberculous parents in causing the disease in children—Smith's demonstration that the colon bacillus forms two common kinds of gas in a definite and unmistakable ratio when allowed to act on sugar enables us to differentiate it from another organism that it closely resembles but which is not so characteristic an inhabitant of the human intestinal canal. The whole story of water pollution is bound up in this apparently remote observation.

These and other facts that he and many others have recorded happen to have led within a reasonable lapse of time to a sequence of discoveries that are trans-

lated in terms of obvious usefulness. But for every one of these rapid dividend-paying facts there are multitudes that have as yet no practical significance but which are equally fundamental in the scheme of nature. Those of us who are familiar with the history of scientific discovery know that the bizarre and remote phenomenon which seems to-day unrelated to any human concern may lead to-morrow to inventions of great practical usefulness. We should, each one of us, like to discover at once a cure for cancer, or for tuberculosis, but I venture to say that the final determining step that will lead to either one will be made by some one who is concerned with the orderly development of some obscure and apparently unrelated branch of science as such, rather than with direct attainment of the great objective.

Education, etymologically and in fact, is a process of intellectual self-development. It may be enormously facilitated by instruction, whether by example or didactically, from those who know a little more than the pupil. In medicine Imhotep, Aesculapius, Hippocrates and Galen told their disciples what they believed to be true. In spite of implications that we read into the written fragments they have left us and their subsequent influence on medical thought, I do not believe that any really great teacher ever has believed that he knew it all. Galen, at least, of those that I have mentioned, continually questioned the remote causes of such phenomena as paralysis, and tried to answer his own questions by experimentation. His experiments marked the end of simple observation and pure speculation, and represented the beginning of medical science. Since that time medicine has advanced, intermittently at first, but now swept rapidly on by the stream of medical science. The development and the teaching of this science has until very recently been due to those whose formal education and whose practical service has been the care of the sick. Paracelsus, Harvey and Jenner, to mention only a few, were practitioners of medicine.

Those two of the medical sciences that have interested me most, bacteriology and immunology, carry a new implication as to present methods of growth of medical science in general. They were essentially launched by two men who not only were not medical practitioners, but who had no formal education in medicine—by Pasteur and by Metchnikoff, respectively a chemist and a zoologist. At the present time over half of the professors of the medical sciences in this country, and a still larger percentage of the essential contributors to them, are not medical men in the strict and old-fashioned sense. This shift in personnel means to me two things, namely, that these sciences are becoming increasingly autonomous and important in their general relations, and that they are becoming "purer," by which we mean that their main objectives are theoretical and fundamental rather than practical and applied. These medical sciences, anatomy, physiology, bacteriology and biochemistry, have widely assumed general university importance as educational disciplines, alongside physics, chemistry, zoology and botany, and are no longer simple handmaidens of clinical medicine.

You are all familiar with the development of specialties in medicine and surgery and probably accept it as wise on the whole; personally, you would rather be treated by the man who has had the greatest experience in your particular malady. But the public is largely unaware, and the practical medical men often unconvinced as to necessity of an equally essential specialization in the medical sciences, and at what seems at times their divorce from the concerns of clinical medicine. Practitioners are glad to have us devise and apply the practical tests and specific remedies for the diseases with which they are daily concerned, but can not always understand why we are given quite so much time to demonstrate to students of the healing art certain unpractical phenomena.

It is indeed true that in a school of medicine we are concerned mainly in the education of those whose proper and worthy concern will be the care of the individual patient. The majority of our graduates will never attempt again to tell the true diphtheria bacillus from its harmless relative that is frequently encountered in the healthy throat, or to do a Wassermann reaction; he is, indeed, not fully competent, and from the standpoint of economy of effort as well, should leave these matters to his laboratory colleague. He must know, however, when and how to obtain materials for such tests, to know the causes of error inherent in them, the necessary controls and to appreciate what the results mean. This can only be learned by some knowledge of the principles as well as the technique of our science.

But there are other things far more important than the facts and the specialized technique which we can teach our students, as embryo practitioners of medicine. We can give them, through historical interpretation and personal example, some inkling of the technique of discovery in medicine; they will thereby better understand their heritage in a noble profession and be more capable of dealing with the research problem which each new instance of disease in reality presents.

I have attempted at the beginning to indicate to you that your school of medicine has long been dedicated to the gaining of new information as well as to handing it on. In my own field, no school has a more illustrious record. Every teacher who is worth

his salt remains a student, constantly questions the ever residual unknown, and attempts to elicit the answer from reluctant nature. I know you will continue to encourage him here through an adequate competence and more important still through opportunity to follow his destiny to the limit of his capacity. He may wander into fields that appear remote from present concern, but it is certain that in such wandering and exploration lies future knowledge and the practical accomplishment of to-morrow.

THE SOLAR ECLIPSE

THE LICK OBSERVATORY-CROCKER ECLIPSE EXPEDITION TO FRYEBURG, MAINE

THE assembling and adjustment of instruments to be used in observations of the total eclipse of the sun on August 31, 1932, by members of the Lick Observatory-Crocker Eclipse Expedition to Fryeburg, Maine, have been completed, and the entire equipment, weighing approximately four tons, boxed and shipped to the station. The shipment reached Fryeburg early in August, and the members of the expedition will be very busy there for the four weeks to follow in erecting the instruments, making final tests of all adjustments and rehearsing the program to be carried out in the critical 99 seconds during which the moon cuts off completely the light from the sun's photosphere.

This program includes both photographic and spectrographic observations. To photograph the corona, three telescopes will be set up. Two of these have Ross lenses of five inches aperture and 15 feet focal length and are provided with magazine plate holders to permit making the exposures in quick succession. The third has a Ross lens of four inches aperture and five feet focal length. This will be used to secure photographs of the corona in light of four distinct colors, violet, yellow, red and infra-red.

Four spectrographs are provided for the study of the flash spectrum of the sun. Two of these, fixed in position, will receive light from a coelostat mirror and will make continuous records of the flash spectrum from the point of appearance of the lines of lowest level to the point of disappearance of those of highest level. This is accomplished by having the plates move at a uniform rate in the focal plane of the instruments, which are therefore commonly designated as moving-plate spectrographs. One of these will record the spectrum from the K line to $\lambda 4700$, with a dispersion of 3.5 Angstrom units to the millimeter, the other, the spectrum from $H\beta$ to $H\alpha$ (dispersion, 7.5 A. per mm). Two other spectrographs, mounted on a polar axis and pointed directly toward the sun, are of the slitless type and will record on fixed plates the crescent-shaped lines, as they are usually observed. Both are equipped with magnetic shutters operated by clock-work, and special plate holders to permit obtaining exposures on moving-picture film at the rate of one every other second. One of these, equipped with a Michelson grating and a Ross camera lens of five-foot focus, will record the spectral region from $\lambda 3800$ to $\lambda 7000$; the other one, provided with two prisms and a camera lens (72 inches focal length) of ultra-violet glass, the region from $\lambda 3200$ to $\lambda 4700$.

Another polar axis will carry three spectrographs to secure plates from which the wave-lengths of the emission lines in the inner corona may be measured. One of these, provided with an etalon, is designed to measure, with the highest degree of accuracy, the wave-length of the well-known green line at approximately $\lambda 5303$. The same axis will carry two other spectrographs specially designed for speed in recording faint spectra. With these it is hoped that further data may be obtained concerning the motion of material in the outer corona.

Astronomer J. H. Moore will be in charge of the expedition, and will have as his associate observers Astronomer W. H. Wright and Assistant Astronomer D. H. Menzel, of the Lick Observatory staff, and Associate Professor C. D. Shane, of the astronomical department of the University of California, Berkeley. Mr. Ben Osen, foreman and carpenter, and Mr. J. F. Chappell, photographer, at the Lick Observatory, will assist the observers, and it is probable that one or two astronomers from other institutions will be associated with the party.

Regent William H. Crocker, who financed expeditions sent out by the Lick Observatory to observe the eclipses of 1900, Georgia; 1901, Sumatra; 1905, Spain, Egypt and Labrador; 1908, Flint Island; 1914, Russia; 1918, Goldendale, Washington; 1922, Wallal, Australia; 1923, Lower California; and 1930, Camptonville, California, is the generous patron of the present expedition also. We most gratefully acknowledge our indebtedness to him for the contributions to knowledge it has been possible to make through the successful observations of eclipses in seven of the earlier years, and for giving us the opportunity of adding to them at the coming eclipse.

R. G. AITKEN,
Director, Lick Observatory

FUTURE TOTAL SOLAR ECLIPSES IN THE UNITED STATES

AFTER the total solar eclipse of August 31, 1932, when will there be another visible in the United States? A number of advertising circulars and newspaper articles have appeared with the statement that "there will not be another total eclipse of the sun visible in this country until the year 2024." Others have set the date as 2017 or 1970. But as recently reported in *Science News*,[1] Dr. Robertson, of the Nautical Almanac Office, U. S. Naval Observatory, has pointed out that the total eclipse of July 20, 1963, will be favorably located for observation from certain points in Maine.

Perhaps it will do no harm to repeat that the next four total solar eclipses visible in the United States will occur on July 9, 1945, June 30, 1954, October 2, 1959, and July 20, 1963. The first three of these will be visible at or near sunrise in the United States and consequently will not be favorably located in the sky for professional observation. The fourth will be favorable for observation from certain points in Canada and Northern New England.

The information contained in the following paragraphs is based on computations made using the elements given in Oppolzer's "Canon der Finsternisse." This very valuable book (now out of print) contains elements for every eclipse, solar or lunar, occurring between 1207 B. C. and 2162 A. D., and in addition contains maps showing the approximate paths of the moon's shadow on the earth for each solar eclipse visible in the northern hemisphere and for a few others. It is the approximate character of these maps which is responsible for many of the erroneous statements about coming eclipses. For instance, an excellent book on astronomy which appeared in 1931 has a map showing the paths of total solar eclipses from 1918 to 2000 A. D. in which the path of the 1932 eclipse is shown as passing down between Labrador and Greenland and not crossing New England at all! The elements given by Oppolzer are somewhat more accurate than his maps. For a discussion of the accuracy of Oppolzer's elements and maps, one may refer to "A Test of the Accuracy of Oppolzer's Eclipse Predictions," by Mrs. Isabel M. Lewis.[2]

It may be of some interest to give approximate central lines of the paths of totality for the four eclipses mentioned above. For the eclipse of July 9, 1945, the moon's shadow will strike the earth at sunrise just north of Boise, Idaho. It will sweep across Manitoba passing near Winnipeg, across the northwestern section of Ontario, over Hudson Bay and across the northern part of Quebec. For a point just south of Hudson Strait, the duration of totality will be about a minute. The sun will be about 24° above the horizon there.

For the eclipse of June 30, 1954, the moon's shadow will strike the earth at sunrise in north central Nebraska. It will pass over Lake Superior, going near the southern end of James Bay and on out near the southern tip of Greenland. For a point in Northern Quebec, the duration of totality will be about two minutes. The sun will then be about 27° above the horizon. For the eclipse of October 2, 1959, the moon's shadow will strike the earth at sunrise in southern New England and will move at once out over the Atlantic Ocean.

For the eclipse of July 20, 1963, Oppolzer's elements indicate that the moon's shadow will come down out of the northwest, passing near the southwestern edge of Hudson Bay and James Bay, crossing Maine near Belfast. The accurate computations made at the Nautical Almanac Office were based on modern elements and consequently their determination of the path of totality of this eclipse will be much more accurate than this. It is interesting to note that, though the maximum duration of totality for the eclipse as given by Dr. Robertson is 100 seconds, the duration of totality for points in Maine will be in the neighborhood of 70 seconds. In this connection, it may be mentioned that for a point in Maine, Oppolzer's elements indicate a duration of totality of 113 seconds instead of 98 seconds as predicted on the basis of modern elements.

For points in Maine, totality in the 1963 eclipse will begin about 5:40 P. M., Daylight Saving Time, but because it will be near the middle of the summer, the sun will be almost as high above the horizon as it will be at Fryeburg, Maine, at this year's eclipse.

CHARLES H. SMILEY

BROWN UNIVERSITY

OBITUARY

GRAHAM LUSK

GRAHAM LUSK died in New York on July 18, after a brief illness. He had just completed writing the obituary notice of his old friend, Max Rubner. These two great pupils of Carl Voit had extended the work of their former master and had placed on a strong foundation the modern science of nutrition. Dr. Lusk had not only made important additions to our knowledge by his own investigations but also had been the chief means of disseminating in this country

[1] SCIENCE, n. s., 75, 1956, viii.

[2] Publ. Amer. Astr. Soc., 7, 3, 92–93, February, 1932.

and Europe the contributions of Voit and Rubner. He had been our strongest connecting link with the old masters and had transmitted to us what was best in the scientific laboratories and academic circles of this and previous centuries. No one who came in touch with him can forget his force of character, his kindliness, his enthusiasm and his devotion to science.

It takes many generations to make a man like Graham Lusk. He came of an old and prominent family and his father, who had studied medicine in this country and Germany, had been one of the first American physiologists before he devoted himself to practice. Graham Lusk was born in Bridgeport, Connecticut, on February 15, 1866. He studied chemical engineering at the Columbia School of Mines in New York and graduated with the degree of Ph.B. in 1887. For the next few years he worked in Munich under Carl von Voit and received the degree of doctor of philosophy in 1891. At that time Voit was at the height of his fame and he was surrounded by a distinguished group of pupils. Among them were Dr. Lusk's lifelong friends, Prausnitz, Max Cremer, Otto Frank and Friedrich Müller.

On returning to this country he was appointed instructor in physiology at Yale and in 1895 made professor. Three years later he was called to the chair at New York University and Bellevue Medical College. In 1899 he married May W. Tiffany, of New York, who with their three children, survives him. In 1909 Dean Polk induced Dr. Lusk to accept the professorship of physiology at Cornell University Medical College in New York City, a post which he filled with distinction until a few days before his death.

At Yale Dr. Lusk started his work on phlorizin diabetes, which led to a prolonged investigation of the sources of glucose in the body. When he came to New York he had the opportunity of extending his observations to the metabolism in human diabetes. In both conditions he found a definite ratio between the dextrose formed in the organism and the protein metabolized as represented by the nitrogen excretion. By means of this D:N ratio he studied the various amino acids as sources of carbohydrate. When he moved to Cornell Medical College he was given the facilities to construct a respiration calorimeter of the Atwater-Rosa-Benedict type suitable for dogs. At last he had the chance to study in detail in hourly periods the metabolism of carbohydrate, fat and protein.

Dr. Lusk's active work as scientific director of the Russell Sage Institute of Pathology began in 1912. By means of an affiliation with the Second Medical (Cornell) Division of Bellevue Hospital he was able to devote the entire small income of this institute to the purchase of apparatus and supplies and the salaries of investigators. A respiration calorimeter for human subjects was constructed near the medical wards of Bellevue Hospital. During the course of the next twenty years he was able to plan experiments on dogs and supplement them by means of the observations on human subjects. For example, his work on phlorizin diabetes on animals could be checked by the study of patients with severe diabetes. He had demonstrated the large amount of glucose that could be derived from the protein metabolism and the relatively insignificant amount that could be ascribed to fat. His figures were the basis for the calculations in all the extensive work on severe diabetes that was being carried on throughout this country in the era before the discovery of insulin. They are still employed in all exact studies of the carbohydrate metabolism.

Many years were devoted to the difficult subject of specific dynamic action of the various foodstuffs, and his carefully planned experiments will always serve as a reservoir of facts. He was never quite satisfied as to theories which would explain these facts. His allegiance to the school of Voit and Rubner as well as his own firm convictions made him an ardent supporter of the significance of surface area in the determination of the basal metabolism. Another great interest was the respiratory quotient and we are indebted to him, more than to any other man, for the realization of the knowledge that can be obtained from quotients when the technique is fully adequate.

Graham Lusk not only excelled as an investigator but also in the many responsibilities that fall upon the head of a department of physiology. He spent a great deal of time and thought upon the teaching of medical students and his course of lectures on nutrition may serve as a model for future generations. Many of the students complained that it was above their heads, but they all realized that it was not above the level where their heads should be. He spoke with force and clearness and never hesitated to give in detail the classical experiments on which the knowledge of nutrition is founded. All felt the stimulus of contact with a great man of the present generation and through him they touched the old masters.

Perhaps the chief service of Graham Lusk was his constant readiness to help younger men. There are hundreds of us who have gone to him with our problems, and we have always received his aid and inspiration. Not only the men who worked in his own laboratory but those from far distant parts of this country and Europe are indebted to him for much of the best parts of their publications. Unless

he himself had taken an active share in the conduct of an experiment he would never attach his name to a paper. Whenever he published with younger men his name appeared last and there were no heart-burnings in his laboratory over that coveted first position on the title page which is of value only to those men who would otherwise remain insignificant. On rare occasions, when he felt that a young man was insincere or totally unprepared for his task he would act firmly and promptly for the good of the scientific world. For all others he was full of encouragement and appreciation, and he cherished the enthusiasm of youth because he himself retained it to the last day of his life.

Scientific meetings were always a particular source of pleasure and he played an important part in such gatherings. He himself had helped to found the Harvey Society of New York, the Society for Experimental Biology and Medicine and the American Society of Biological Chemists. He was an active or honorary member of physiological or scientific societies of Berlin, Great Britain, Edinburgh, Halle, Vienna and Brussels. During the great war he served on the Inter-Allied Scientific Food Commission as one of the representatives of this country. He was a member of the National Academy of Sciences, and a few weeks before his death was notified of his election to the Royal Society of Great Britain. He had been given honorary degrees by the Universities of Yale, Glasgow, Edinburgh and Munich.

A great buoyancy of spirit, cheerfulness, keen sense of humor and genius for friendship were Graham Lusk's chief personal characteristics. He was a prince among men, a delightful host, and in his hospitable home, either in New York or on Long Island, he entertained a succession of visiting scientists and once even the whole International Physiological Congress.

He had overcome in a surprising manner the handicap of deafness which made it difficult for him to follow general conversation and to estimate the finer modulations of his own voice. In spite of this he was a good conversationalist, an effective public speaker, always outspoken, always individual. In many ways deafness was an asset in securing him time to read and write without distraction. A tireless worker with a retentive memory he had accumulated an extraordinary knowledge of the literature and he gave it to the world, well digested, in his text-book, "The Elements of the Science of Nutrition," which appeared in four editions between 1906 and 1928. He had a sense of reverence for the good work of his predecessors and was not slow to take up cudgels in their defense. It was a pleasure to see him go into action with the full force of his own laboratory and the support of his many pupils in other institutions throughout the country. For example, in his recent controversy regarding the formation of glucose from fatty acids practically every one of his former associates published some evidence which strengthened his position. Although emphatic and fearless in dispute, he never lost the friendship of those whose theories he opposed.

Strongly imbued with the spirit of research and the highest ideals of academic culture, he began his work for the reform of medical education at the time he received his first professorship. His efforts in behalf of better compensation for professors were vigorous but only partially successful. He was a leader in the movement to develop teachers in the clinical departments of medical schools who might be capable of research work of the highest order. At first he endorsed the full-time plan for clinical teachers, believing that it was the best way to give them the opportunity to develop strong departments. Later he modified his views and opposed rigid adherence to the full-time program whenever this interfered with academic freedom. Always an ardent supporter of the freedom of faculties and the responsibility of the heads of departments, he fought any influence that he considered dangerous to the vital spirit of our universities.

The physiologists, biochemists and clinicians have lost a leader, a dear friend, a man who represented all that was best in the academic life of our country.

EUGENE F. DU BOIS

SCIENTIFIC EVENTS

THE BRITISH OPTICAL INDUSTRY

A LUNCHEON organized by the optical industry was held recently at the Holborn Restaurant, London, to introduce a number of new instruments, designed and made exclusively by British firms, for the examination of the eyes. Before last September, the London *Times* states, 80 per cent. of the apparatus used in the British optician's practice was imported from the Continent or America. The proportion has now been reduced to about 40 per cent., and it is probable that in the near future there will be a further reduction to 20 per cent. The importance of this British advance in an important scientific industry may be realized when it is stated that approximately 10,000,000 people in Great Britain wear competently prescribed glasses.

Mr. Osmond P. Raphael, chairman of the Optical Manufacturers' Association, who presided at the

luncheon, said, as reported in the *Times*, that they were met to celebrate an achievement of no mean order in the field of ophthalmic optical instruments. Their industry by its nature had an international character. It was scientific, or should at its best be scientific, and consequently must feed on the knowledge and research of mankind in general. When, however, they concerned themselves with the application of principles to specific instances they came into a realm where national characteristics had their proper place. In this realm the time had come to glory in a definitely national achievement of British optical engineering, in the matter of a refracting unit. If its father was a pioneer American instrument, its mother was British optical engineering skill. The midwife was a depreciated currency, and possibly its godparents were the key industries duty and the recently imposed protective tariffs. The instruments to be marketed would stand comparison with the finest productions of the Continent and America, and he congratulated the makers, the Ellis Optical Company.

Mr. A. E. Turville proceeded, according to the *Times*, to give a demonstration of apparatus which included the British refracting unit, the Dobson retinoscope, the Turville-Stewart ophthalmoscope, the Turville dynascope, a Tert-type drum and the Scotometer. He said that the refractor consisted of over 1,000 separate parts and had all kinds of combinations of lenses. The use of the old trial case and frame caused a certain amount of discomfort to the patient, but with the new apparatus there was no discomfort. Examination could not be carried on without apparatus, and it had been a sore point with him in the past that certain Continental or American instruments far excelled British ones or there was no British instrument in existence. All the apparatus he had used that afternoon was British made and was perfectly accurate in use and construction. The refracting unit marked a great advance in instrument design in Great Britain. He would like to urge on British designers and manufacturers that they should continue their efforts, so that very soon all our consulting rooms, hospitals and clinics would be equipped throughout with British apparatus.

THE COSMIC RAY SURVEY

PROFESSOR ARTHUR H. COMPTON, of the University of Chicago, has arrived in Mexico City to continue his study of cosmic rays on the summit of the Nevado de Toluca, 14,950 feet above sea-level.

Dr. Compton had been making measurements on Mt. Huancayo, in Peru, and previously in Hawaii, Australia, New Zealand and Panama. He will return to Chicago late in August and then join a group working in the Rocky Mountains.

Further new tests are now being made for Dr. Compton in Baffin Land, near the north magnetic pole, by Dr. D. LaCour, of the Meteorological Institute of Copenhagen. Dr. Ralph Bennett, of the Massachusetts Institute of Technology, is heading a party which has made extensive measurements in the region of Mt. McKinley, Alaska. Dr. Bennett's group is carrying on the ill-fated Alaska project which cost two lives in June. Further parties are working in South Africa, in India and the South Seas, and in Patagonia and Chile.

Dr. Ernest O. Wollan, instructor in physics at the University of Chicago, is on his way to Spitzbergen, 600 miles south of the North Pole. Using the same type of heavily-leaded electrometer now being employed by four other parties working under Dr. Compton's direction, he will make his tests at Advent Bay and at the edge of the ice-packs, at 80 degrees north latitude. Dr. Wollan will later proceed to Zurich to make further tests on the Jungfrau, where Dr. Compton worked last September.

EFFECT OF THE ECONOMY MEASURE ON THE DEPARTMENT OF AGRICULTURE

IN accordance with section 204 of the act recently passed by Congress, known as the economy bill, which was signed by the President on June 30, no person in civilian service in any branch of the United States Government who had reached the retirement age prescribed for automatic separation from the service could be continued in the service after June 30 except by executive order of the President. On June 30 there were 157 employees in the Department of Agriculture who had reached the retirement age, who were eligible for retirement, and who were subject to the provisions of the act. Of this number three were continued, namely: Professor Charles F. Marvin, chief of the Weather Bureau; Dr. Isaac M. Cline, principal meteorologist in charge of the Weather Bureau station at New Orleans, Louisiana, and Dr. William J. Humphreys, principal meteorologist, Weather Bureau, Washington, D. C.

Dr. A. F. Woods, director of scientific work, has sent in response to a request from the editor a statement in regard to the effect of the economy bill on scientific workers in the Department of Agriculture, which reads as follows:

> The professional and scientific workers in the Department of Agriculture are in hearty accord with the policy of rigid economy in expenditures of the government. They have accepted the withholding of normal salary increase without any complaint, though in many cases it means hardship.

The five-day week plan, valuable as it is for workers in general, does not fit the requirements of scientific work. This needs no amplifications to make it clear to scientific men.

The furlough or reduction in salary makes the situation still more difficult, but it is our observation that the scientific workers generally are making the readjustments necessary to keep within reduced incomes.

The reduction of annual leave (no leave with pay for the current year) and 15 days instead of 30 after this year, throws the government still further out of line with educational institutions and will make the government positions less attractive than those in educational institutions.

It is too soon to appraise very accurately what the full effect of this legislation will be. Our policy in administering it will be to secure the greatest possible saving with the least injury to the work and workers.

CANADIAN-AMERICAN PHARMACEUTICAL CONVENTION

THE program of the joint meeting of the American Pharmaceutical Association and the Canadian Pharmaceutical Association during the week of August 22–27 at the Royal York Hotel, Toronto, has been completed. The Ontario Retail Druggists Association will also hold its annual meeting at this time and will have charge of the entertainment of the delegates. The Pharmaceutical Society of Great Britain will be officially represented by President, F. G. Hines; past-president, Herbert Skinner; secretary, Hugh N. Linstead; and Thomas Marns, a member of the council. Mr. Skinner is also chairman of the British Pharmaceutical Conference. This will be the most important international pharmaceutical gathering held in North America.

The Plant Science Seminar, the Committee on Pharmaceutical Syllabus and the Conference on Pharmaceutical Research will meet in Toronto during the week preceding the Convention. The American Association of Colleges of Pharmacy and the National Association Boards of Pharmacy will hold their sessions on Monday and Tuesday, August 22 and 23. The Canadian Pharmaceutical Association and the Ontario Retail Druggists Association will hold their business sessions on Tuesday, August 23, and their members will be free to attend the various sessions of the American Pharmaceutical Association on Wednesday, Thursday and Friday. Saturday will be spent visiting the Canadian National Exposition.

On Wednesday forenoon and Thursday afternoon there will be joint sessions. At the first, the Presidents of the organizations, George A. Burbridge, of Nova Scotia, and Walter D. Adams, of Texas, will deliver their presidential addresses.

Mr. Marns, as chairman of the Committee on Law Enforcement of the Pharmaceutical Society of Great Britain, will take part in the Conference of Law Enforcement Officials, and Secretary Linstead, of the Society, in the Conference of Pharmaceutical Association Secretaries. The five sections of the American Pharmaceutical Association — Scientific, Practical Pharmacy and Dispensary, Educational and Legislative, Commercial Interests, and Historical—have an unusual number of papers and discussions dealing with practically every phase of pharmacy. Canadian pharmacists will participate in all the programs, and a number of questions of mutual interest to the pharmacists of the United States and Canada will be considered in addition to the usual reports and items of business.

There will be a reception and dance on Monday evening, the joint banquet on Tuesday evening, a moonlight sail on Lake Ontario on Wednesday evening, a Farewell Party and Dance on Friday evening and an all day visit to the Canadian National Exposition on Saturday. In addition, special entertainment for the ladies, Veterans Luncheon on Thursday, sight-seeing parties, a number of special dinners and luncheons for associations, alumni and other groups. Special transportation rates by rail and water are offered.

MEETING OF THE INTERNATIONAL ASTRONOMICAL UNION AT HARVARD OBSERVATORY

DIRECTLY following the total eclipse of the sun, the triennial meeting of the International Astronomical Union (postponed for a year in order to coincide with the eclipse) will be held in Cambridge, Massachusetts. The meeting is open to delegates and specially invited guests. About eighty overseas astronomers have already signified their intention of attending the meeting.

Sessions of the general assembly, and meetings of scientific commissions, will be held in Alice Longfellow Hall of Radcliffe College. The student dormitories of Radcliffe College have also been lent by the college for the accommodation of the delegates.

The program of the meeting includes: Reception by the American Astronomical Society (Evening, September 2); garden party at the observatory residence (Afternoon, September 3); Excursion to Oak Ridge Station of the Harvard Observatory (September 4); Excursion by boat to Plymouth (Afternoon, September 6); Excursion to Wellesley College (Afternoon, September 8). On the evening of September 8 there will be a dinner, by the invitation of the American Section of the International Astronomical Union.

Meetings of the General Assembly of the Union, and of the various scientific commissions, will be held on the morning of September 3, the morning and after-

noon of September 5, the morning of September 6, the morning and afternoon of September 7, and the mornings of September 8 and 9.

On the evening of September 7 there will be a visit to the Massachusetts Institute of Technology. In connection with this visit a public lecture will be given at the institute by Sir Arthur Eddington, Plumian professor of astronomy at the University of Cambridge, on "The Expanding Universe." Admission to the lecture will be by free ticket.

SCIENTIFIC NOTES AND NEWS

DR. JOHN J. ABEL, professor emeritus of pharmacology at the Johns Hopkins University, president of the American Association for the Advancement of Science, returned on July 24 from Scotland, where he had received an honorary degree from the University of Aberdeen.

THE University of Sheffield has conferred the degree of doctor of science on Sir Alfred Ewing, president of the British Association for the Advancement of Science. Dr. Ewing was formerly professor of mechanism and applied mechanics at the University of Cambridge, and later, until his retirement in 1929, principal and vice-chancellor of the University of Edinburgh.

DR. OSWALD VEBLEN, professor of mathematics at Princeton University, has been appointed the delegate from the American Association for the Advancement of Science, to the British Association, which meets in York from August 31 to September 7.

DR. HENRY S. WASHINGTON, petrologist of the Geophysical Laboratory of the Carnegie Institution of Washington, has been elected an honorary member of the Mineralogical Society, London.

THE seventy-fifth anniversary of the birthday of Dr. Frank J. Sprague was celebrated at a banquet given in his honor at the Engineering Societies Building on July 27. The speakers included Frank Hedley, president of the Interborough Rapid Transit Company; Rear Admiral S. S. Robison, retired, and Dr. John H. Finley, of the editorial department of *The New York Times*. Mr. Sprague responded with an address reviewing his long career, concluding with a prophecy of the progressive electrification of the main trunk line railways as "the next great step in advance after the present depression." Admiral Robison presented to Mr. Sprague a set of volumes containing more than five hundred autographed letters from friends all over the world, with photographs of the writers. A letter from President Hoover is included in the volume which reads: "I send you my cordial felicitations on your seventy-fifth birthday and all good wishes for the future. Your contribution in the development of the electric motor, followed by the application of electricity to street railways and to elevators, links your name for all time with that distinguished group of inventors and engineers whose pioneer work made possible so many of our present utilities, comforts and conveniences. It is fitting that the engineering and scientific world should show general recognition of your noteworthy services to the electric art, and it is with regret that I find I shall not be able to be present at your anniversary celebration."

MAJOR OSCAR VAN PELT STOUT, irrigation engineer, Bureau of Agricultural Engineering, now stationed at Berkeley, California, was awarded the first Cyrus Hall McCormick medal of the American Society of Agricultural Engineers at the twenty-sixth annual meeting, held at the Ohio State University.

DR. ERNST WEBER, research professor of electrical engineering at the Polytechnic Institute of Brooklyn, has won the annual award of the American Institute of Electrical Engineers for a paper read at Asheville, North Carolina, last year on "Field Transients in Magnetic Systems—a Study of Field Transients in Iron Cores partially Laminated and partially Solid."

THE joint committee of the Royal Society of Edinburgh, the Royal Physical Society and the Royal Scottish Geographical Society has awarded the Bruce Prize for the period of 1930–32 to Mr. Herbert G. Watkins, for contributions to the topography of Spitsbergen, Labrador and East Greenland and investigation of the ice cap of Greenland.

RESOLUTIONS of appreciation and a gold watch were presented to Dr. John F. Barnhill, Miami Beach, Florida, at the close of a graduate course on the eye, ear, nose and throat, which he conducted at Indiana University School of Medicine recently with the assistance of members of the faculty. Dr. Barnhill has been professor of surgery of the head at Indiana University School of Medicine for many years.

DR. HARRY C. MESSINGER, Providence, has been awarded the annual Fiske Fund Premium for his dissertation on "The Value of Ocular Signs and Symptoms in the Diagnosis of General Disease." This fund was established nearly 100 years ago by Caleb Fiske for the encouragement of original work.

DR. WILLIAM WARWICK, St. John, New Brunswick, was elected president of the Canadian Public Health Association at the recent annual meeting in Toronto.

AT a recent meeting of the Royal College of Surgeons Sir H. J. Waring was elected president in succession to Lord Moynihan, who has held office for the past six years. Mr. W. Sampson Handley and Sir Percy Sargent were elected vice-presidents.

DR. PAUL KIRKPATRICK, professor of physics in the University of Hawaii, has resigned to accept an appointment on the faculty of Stanford University.

DR. H. R. DESILVA has been appointed professor of psychology in the department of education and psychology of the Massachusetts State College.

JOHN WYNN GILLESPIE has been appointed professor of botany at Arizona State Teachers College at Tempe.

AT Armstrong College, Newcastle, England, the following appointments have been made: Dr. H. L. Riley, professor of inorganic and physical chemistry; Professor G. R. Clemo, director of the department of chemistry; J. S. Patrick, lecturer in mechanical engineering at the Municipal Technical College, Hull, lecturer in mechanical engineering.

DR. HALBERT L. DUNN, formerly medical statistician at the Mayo Clinic, Rochester, has been appointed superintendent of the University of Minnesota Hospitals. He succeeded Mr. Paul H. Fesler, who recently resigned to become superintendent of Wesley Memorial Hospital, Chicago.

MRS. JAMES STARR, of Germantown, has been re-elected president of the Woman's Medical College, Philadelphia.

DR. R. W. LEIGHTON, research fellow at the University of Oregon, has been named by the State Board of Higher Education executive secretary of the Oregon Research Council. He will be in charge of all research projects except those in agriculture.

PROFESSOR G. PROCTOR COOPER, of East Lee, Massachusetts, and Mr. H. Huebner, of Groton, Massachusetts, have been appointed collaborators of the New York Botanical Garden. Mr. Cooper is to visit the West Indies and South America, making collections of plants and woods. Mr. Huebner is on an expedition to the East Indies, where he will give special attention to collecting ornamental plants.

DR. REID HUNT, professor of pharmacology at Harvard University, and Mrs. Hunt left for Europe on July 28.

DELEGATES to the tenth International Congress of Psychology, which is to be held at the University of Copenhagen from August 22 to 27, 1932, have been appointed by the government as follows: Carl Emil Seashore, *chairman*, director, laboratory of psychology, and dean, Graduate College, University of Iowa; Herbert Sidney Langfeld, director, laboratory of psychology, Princeton University; Walter Richard Miles, professor of psychology, Yale University; Margaret Floy Washburn, professor of psychology, Vassar College; Harry Porter Weld, professor of experimental psychology, Cornell University.

PROFESSOR R. RUGGLES GATES, of King's College, University of London, has been invited to give three De Lamar Lectures at the Johns Hopkins University in the week beginning October 24 on "The Principles of Heredity in Man, and their Application to Society." He is also giving two lectures at the University of Toronto, and is spending the week beginning October 10 as visitor to the University of Minnesota. Dr. Gates has been appointed chief delegate of the British Government to the sixth International Congress of Genetics at Ithaca. He will also represent the Royal Anthropological Institute at the third International Congress of Eugenics in New York.

PROFESSOR L. M. MASSEY, head of the department of plant pathology, Cornell University, left on August 4, to spend his sabbatical leave in California. Dr. Carl E. F. Guterman will be the acting head of the department in his absence. Dr. Massey, who is especially interested in the diseases of ornamental plants, will spend the year at the University of California.

DR. C. E. CHARDON, president of the University of Porto Rico, and Professor R. A. Toro, of the Agricultural College at Mayaguez, Porto Rico, are now on a three months' collecting expedition in Venezuela. They are making a collection of fungi of wild and cultivated plants growing in Venezuela. The entire collection will be deposited in the herbarium of plant pathology at Cornell University. Dr. Chardon has been decorated with the great cross of the "Libertador" of the Republic of Venezuela. The Venezuelan government is providing them with every facility for their work. They are collecting over the historic route taken by Alexander Von Humboldt on his exploring expedition in that country in 1800.

A CAMERA so large that the photographers will work inside of it, and a specially constructed interferometer, believed to be the largest ever made for the purpose, will be set up at Fryeburg, Maine, by University of Michigan astronomers for the eclipse of the sun which occurs on August 31. The camera will have a focal length of forty feet, and will be built stationary. Two men will work inside it, Baldwin Curtis, junior in the university and son of Professor Heber D. Curtis, being in charge. Fast work during the 99 seconds of the eclipse will yield six or seven plates. Professor

Curtis, director of the Michigan observatories, has been working on a special interferometer, which will be eight feet long and which uses etalon plates five inches in diameter.

A CORRESPONDENT of the London *Times* reports that the first stage of the Royal Observatory's expedition to Canada to observe the total eclipse of the sun was accomplished on July 13, when three and a half tons of scientific instruments and equipment were loaded on an Admiralty motor-lorry at Greenwich, in readiness for the voyage to Quebec the following week. The Greenwich party has been preparing for the expedition for many weeks, and every possible detail of equipment that might be needed in the isolated region to which it is going has been included in the 40 cases which make up the consignment. The *Times* states that the importance of the Royal Observatory's expedition to Parent, in the far north of the province of Quebec, is increased by news received at the Observatory from Canada. It had been understood that an expedition from the Dominion Observatory at Ottawa would also be making Parent its base of operations. Now it is learned that for reasons of economy the Canadian expedition has been abandoned. Dr. J. Jackson, who, with Mr. C. R. Davidson, forms the Greenwich observing party, said, "It is all the more necessary that all our four instruments should be operated. We expect to have the assistance of two astronomers from Prague, and it is possible that other competent observers will be available by the time of the eclipse. The population of the settlement at Parent is 165, and we hope that it will not be difficult to secure the necessary labor for the preparation of our camp. I understand that it is possible that Russian and Japanese eclipse expeditions will be in Canada. There are two British expeditions besides that from Greenwich—from Cambridge and the Imperial College of Science, London."

THE United Press states that a French government mission sent into Africa to study the native fauna has reported that unless drastic measures are enacted immediately, elephants, horned rhinoceros, giraffes and dwarf hippopotamuses will be killed off in the French colonies within a few years. The mission recommends a Franco-British-Belgian treaty forbidding the export of rhinoceros horns—particularly sought by Chinese for their alleged medicinal value—and severe laws to curb the shooting of animals by native and white game hunters. "The worst enemies of the native fauna of Africa are the natives who kill them for their meat, hide and tusks, and the sportsmen of Europe and America who organize expeditions for the sole purpose of acquiring hunting trophies for the decoration of their smoking rooms." The report points out that Belgian Congo soon will be without elephants except those kept in national parks. Each battalion of natives working on government building projects is allowed to kill one elephant per week for food. The great herds of the Congo will be thinned readily if each of the score of battalions is allowed fifty-two elephants a year.

THE University Court of the University of Aberdeen has decided that in future the Regius professor of surgery shall devote the greater part of his time to the duties of the chair and that his private practice shall be limited to cases seen and treated in Aberdeen—with rare exceptions. It is understood that preference will be given to those candidates of wide experience of clinical surgery and acknowledged power of teaching who, by their special training and record, have given evidence of their capacity for, and interest in, research. The holder of the chair is an honorary surgeon to the Aberdeen Royal Infirmary with charge of beds, and an honorary consultant in the municipal hospitals.

A NEW curriculum, designed to fit the agricultural student for farm life or for the professional and business fields is to become effective with the fall term of West Virginia University. All candidates for the baccalaureate degree will follow for the first two years a uniform schedule, which includes courses in the sciences which are fundamental to agriculture, as well as certain specified courses in agriculture. During the remaining two years the student is permitted a choice of one of four curricula—agricultural economics, animal industry, plant industry and teacher training. Certain basic courses in animal husbandry, dairy husbandry and horticulture are required in each of these curricula. Provision is made also for the student who may wish to pursue a rather broad program of electives during the last two years.

WE learn from Science Service that funds for the scientific and engineering work of the U. S. Coast and Geodetic Survey, which were cut about 22 per cent. by the regular appropriation bill for the Department of Commerce, are restored by a provision in the Emergency Relief Act passed at the close of the last congressional session. Under the provisions for public works, the new act provides "For the engineering work of the Coast and Geodetic Survey, Department of Commerce, heretofore authorized, $1,250,000." This money may be used for the regular work of the survey. As the regular appropriation bill passed Congress, the funds were reduced $676,120 below what they were in the fiscal year ending on June 30, 1932.

DISCUSSION

AMERICAN SCIENTIFIC ORGANIZATIONS CALL FOR STABILITY OF RULES OF ZOOLOGICAL NOMENCLATURE

STABILITY of the rules of zoological nomenclature is becoming increasingly important. The action of the International Zoological Congress, at Padua, Italy, in 1930, in adopting the Horn resolution,[1] stimulated interest in this subject, and led to a meeting in Washington, D. C., of members of the nomenclature committees of several local, national and international American societies interested in zoology.

At this meeting on May 8, 1931, the following resolution was approved:

> We, the undersigned, members of the committees on nomenclature of the various scientific societies listed below, view with alarm the action taken on the Horn Resolution at the International Zoological Congress held in Padua, Italy, in 1930, and consider that this action establishes a precedent which seriously jeopardizes the stability of zoological nomenclature. The adoption of the Horn Resolution by the Congress was contrary to the 1901 agreement, which provided that proposals regarding the international rules of zoological nomenclature would not be submitted to the Congress without the unanimous recommendation of the International Commission on Zoological Nomenclature. We believe that the passage of the Horn Resolution was unparliamentary, contrary to the methods of procedure approved by the International Commission on Zoological Nomenclature, and, consequently, invalid. We, therefore, reaffirm our adherence to the International Rules of Zoological Nomenclature as constituted under the 1901 agreement.

The foregoing resolution has been formally adopted by the following ten organizations:

American Society of Zoologists,
Section F, American Association for the Advancement of Science,
American Society of Mammalogists,
American Society of Parasitologists,
American Society of Ichthyologists and Herpetologists,
American Malacological Union,
Biological Society of Washington,
Entomological Society of Washington,
Helminthological Society of Washington,
Geological Society of Washington.

This matter is here brought to the attention of American zoologists to acquaint them with the action taken. If this position be endorsed by additional organizations (academies, faculties, societies, etc.), it is requested that copies of their resolutions of endorsement be sent to the undersigned.

HARRY C. OBERHOLSER
BIOLOGICAL SURVEY,
U. S. DEPT. OF AGRICULTURE

[1] *Cf.* Stiles, SCIENCE, n. s., lxxiii, 1892, pp. 351–352, April 3, 1931.

BACTERIA IN PENNSYLVANIA ANTHRACITE

SEVERAL times during the last few years notes have appeared in scientific journals and newspapers calling attention to the discovery by Dr. C. B. Lipman of living bacteria in Pennsylvania anthracite. According to Lipman[1] these bacteria are "descendants directly from cells which have lain dormant there from the time of the coal's formation, which, according to one method of the geologist's reckoning, would be fifteen million years, and according to another method, from one to two hundred million years."

In accordance with commonly accepted theories, anthracite was formed from coals of lower rank through the action of dynamic metamorphism or by contact with igneous rocks. A microscopical examination of Pennsylvania anthracite[2] shows that the most resistant plant substances, such as waxes, gums, and resins, have been changed to anthracite. Furthermore, the original argillaceous sediments associated with the vegetation have been changed to shale and slate-like rocks containing micas and other metamorphic minerals. It seems unreasonable, therefore, to expect a relatively perishable substance like the protoplasm of bacteria or the spores thereof to be exempt from the changes which have taken place in their vastly more resistant associates.

Mr. M. A. Farrell and the writer made a careful study of Pennsylvania anthracite taken from the same bed and same mine from which Dr. Lipman secured his samples and concluded that this anthracite contains no bacteria other than common living forms which have found ingress through fracture cracks and coal laminae communicating with surface water and air.[3]

The samples which we examined were collected by ourselves from the Primrose vein in the Otto colliery of the Philadelphia and Reading Coal and Iron Company at Pottsville, Pennsylvania. This location was selected because it was the same one from which Lipman's samples were secured. The fact that we collected our own samples and studied the condition of the coal in place, together with the structural nature of each sample, may have some bearing on the fact that our findings differ from those of Lipman. Apparently Lipman was not aware that his samples came from the side of a pitching syncline outcropping at the surface, and that the outcrop was badly breached, giving free access to surface waters. Lip-

[1] C. B. Lipman, "Living Microorganisms in Ancient Rocks," *Jour. of Bacteriology*, xxii, No. 3.

[2] H. G. Turner, "Constitution and Nature of Pennsylvania Anthracite with Comparison to Bituminous Coal," *Trans. A. I. M. E.*, February, 1930.

[3] M. A. Farrell and H. G. Turner, "Bacteria in Anthracite Coal," *Jour. of Bacteriology*, xxiii, No. 2, February, 1932.

man states that his samples were collected from a place in the mine where there is no evidence whatever of percolating water in or near the point at which the samples were obtained. There may not have been percolating water present when his samples were taken, but that does not mean that there never could have been any there. In his paper Lipman gives 1,800 feet as the depth at which his samples were secured, whereas a check made by myself of the company's maps showed a vertical depth of less than 500 feet beneath the surface of the ground at this place.

Lipman, by making a study of permeability of anthracite, wisely attempts to offset any mistakes that could be made through failure to examine coal in place or in the laboratory. His permeability study, however, is not at all convincing. He selects two pieces of coal, one of which he treats as he did previous pieces, except that the period of heating in a hot-air oven is much longer than that applied to other pieces of coal in which he found bacteria. This particular piece of coal gave negative results. It is difficult to see why it produced negative results, for there was no reason to suspect that this piece of anthracite did not contain the original ancient bacteria. Of course the longer period of heating may have destroyed them, but this could hardly be the case, for Lipman says in another part of his paper that "it seems as if the longer periods of heating cause the organisms to grow more effectively." Regardless of results, I fail to see the value of this test except in confirming my belief that there are no ancient bacteria in anthracite.

The second piece of coal selected for the permeability tests was treated in the same manner as the first up to the point where it was submerged in a suspension of a pure culture of the coccus derived from the coal previously found to contain bacteria. From this point on the procedure was different. In this case "a few colonies all told, perhaps not more than eight or ten, were found," and Lipman concludes from this that "if the coccus in which the coal sample was submerged had penetrated to any extent at all into the coal each culture made from the crushed sample would have shown heavy growth." The fact that he found some bacteria shows, in my opinion, that either they penetrated the coal or represent original bacteria. If they represent original bacteria some similar growth should have been found in the previous piece which actually gave negative results. One must conclude, therefore, that the control piece either was not treated properly or that the few bacteria found actually penetrated the coal.

Entirely aside from the results obtained in these permeability tests it should be noted that the bacteria in which the coal was suspended were in the vegetative form, which presented much larger particle sizes than the "visible or invisible spores" which, according to Lipman, these organisms are capable of producing. Why can not an invisible spore penetrate an invisible crack or pore? Lipman's statement that "particles as big as a coccus are too large to penetrate the coal, either through crevices or microscopic pores," is also meaningless because he fails to give the dimensions of the cocci, pores or crevices in question.

It is difficult to see how reliable conclusions regarding the presence of ancient bacteria in anthracite can be reached without a thorough study of the history, structure and texture of the coal both in the field and in the laboratory. Long before the shaft is sunk the coal has been subjected to possible contamination through circulating ground-waters. As the shaft is sunk, impure water and air advance with it. Practically every mine is equipped with pumps to keep the water low enough to permit working, and even then flooding is not uncommon. The possibility of securing an uncontaminated piece of coal or rock from a mine is so remote that the whole problem resolves itself into a study of permeability. The student of coal petrography realizes that one piece of coal may be impervious, while another piece from the same bed may contain fractures or laminae which could easily be penetrated by large or small bacteria. A permeability study, then, would be of little value without a knowledge of the texture and structure of the sample used.

The reported finding of bacteria millions of years old is news and as such can do no harm. But, when it begins to appear as a fact, and is used to overthrow well-founded theories on the origin of coal, it is time to ask ourselves whether or not it is true. My object in writing this discussion is to check wild theories and speculations which are being advanced by other writers on the assumption that Lipman really found bacteria of great antiquity in anthracite.

HOMER G. TURNER[4]

THE JURASSIC IN OKLAHOMA

WHILE doing field work in the preparation of a paper on the Pleistocene mammals of Oklahoma, the writer visited the valley of the Cimarron River in Cimarron County, Oklahoma, where he learned that some "big bones" had been uncovered along highway 64, just east of Kenton.

The "big bones" proved to be part of a dinosaur since identified as *Brontosaurus*.

The discovery of this specimen is significant in two respects. It is the first distinctly Jurassic dinosaur

[4] Director of Research for the Anthracite Institute, School of Mineral Industries, Pennsylvania State College, State College, Pennsylvania.

discovered in the state.[1] It was discovered in territory previously mapped as Morrison,[2] Comanchean or Jurassic. This evidence warrants placing the Purgatoire as the bottom member of the Cretaceous and assigning the bone-producing horizon (Morrison?) to the Jurassic.

The formation where the bones were found lies near the top of the valley wall, and is a dark brown gray-mottled shale which breaks out readily in somewhat cubical blocks. The same formation may be seen exposed in several places on both the east and west walls of West Carrizo Creek Canyon north of Kenton. In this canyon the Purgatoire and Dakota overlie the Morrison.

After some digging the fifth or sixth rib from the left side, two caudal vertebrae and various fragments were uncovered. The two vertebrae are unbroken and only slightly distorted. Excepting the absence of the head, the rib is in perfect condition. When uncovered, it was lying ventral side up and intact.

The work of excavation will be continued under the direction of the department of paleontology of the University of Oklahoma. A detailed study of the area will be made in order to determine the actual extent of the Jurassic in that part of the state. If it seems advisable, a new map showing the outcrops will be prepared.

The writer wishes to thank Mr. R. C. Tate, of Kenton, Oklahoma, who acted as guide while the party was in the area, and who so kindly pointed out the location of the bones.

J. WILLIS STOVALL
UNIVERSITY OF OKLAHOMA

PEACH MOSAIC—A NEW VIRUS DISEASE

IN the course of field work for the phony peach eradication campaign, conducted jointly by the U. S. Department of Agriculture and state agencies, inspectors observed in certain peach orchards in Brown and in Callahan Counties, Texas, in July, 1931, characters that suggested the phony disease but that appeared to be different. Fresh specimens from these trees were sent to the writer for identification and study. They gave only negative results with the recently discovered laboratory test for the phony disease, which confirmed the fact that the symptoms were not typical for the latter disease. A striking character of this material was the appearance of the twigs. New growth was abnormal both in number and arrangement of branches, and internodes were in most cases abnormally short.

Inoculation experiments were performed on July 15 and 16, 1931, in which 56 peach nursery trees were grafted or budded with material from the Texas specimens. Although the graft and bud-shield unions were in most cases successful, the inoculated trees failed to develop pathological symptoms during the remainder of 1931. With the beginning of growth in the early spring of 1932, symptoms of a virus disease were at once apparent in the new shoots from all aerial parts of the inoculated trees and in new sucker growth from the roots. Internodes were short, buds in the leaf axils started into growth in profusion, leaf-blades displayed striking mosaic patterns and in many instances were small, narrow, irregular in outline and crinkled. Over 95 per cent. of the inoculated plants developed positive symptoms of a mosaic disease. The fact that inoculum from either the root or the shoot of the suspicious trees in the field communicated the disease indicates that infection is systemic. Experiments have been performed for determining whether the disease may be transmitted by juice, but they have not had time to mature. Experimental plants are isolated in a double-screened (wire and cloth) house and every precaution is taken to prevent accidental dissemination of the disease.

In view of the fact that the above-described characters appeared uniformly in all the successfully inoculated plants, the name *peach mosaic* is suggested for the new disease. Not only is peach mosaic interesting in that it constitutes a new member of the group of peach virus diseases, but it is thought to be the first positive, infectious mosaic to be recorded for the peach. Yellows, little peach, rosette and phony disease cause the development of a variety of pathological characters in twig and leaf, but none of them produce mosaic patterns in the leaves.

Only a few trees are known to be infected with peach mosaic at the present time. Forty-two cases were located by inspectors, scattered over three blocks of trees in an orchard in Brown County, and a few cases were seen in an orchard in Callahan County. The supposedly sparse population and limited distribution of peach mosaic would appear to present an ideal case for thorough survey supported by prompt eradication.

A detailed, illustrated description of the disease and the experiments that proved its infectious nature will appear in a forthcoming publication.

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U. S. DEPARTMENT OF AGRICULTURE

A CORRECTION

I HAVE just received from Mr. Hoyt S. Gale, of Los Angeles, a statement of facts which enables me to make two small corrections in my note, "The

[1] Pierce Larkin, *Jour. of Geol.*, v. 18, 1910.
[2] E. P. Rothrock, *O. G. S. Bull.*, 34, 1925.

Muddy Mountain Thrust in Fact and in Fiction," printed in SCIENCE, July 29. Mr. Gale was the first geologist to visit White Basin, in southern Nevada, after the discovery there of the mineral colemanite. He writes that John Perkins recorded his first claim in March, 1920, and not in the fall of that year as I had supposed. However, it was not until November, 1920, that the Western Borax Company acquired an interest in the deposits and began the first mining development in the district. This same company built the automobile road connecting the district with the Union Pacific Railroad; in my article the Pacific Coast Borax Company is given credit for building this road.

Although neither of these points affect the main thought of my published article, I wish to make the corrections in the interest of strict accuracy of the record.

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SOCIETIES AND ACADEMIES

THE NORTH CAROLINA ACADEMY OF SCIENCE

THE thirty-first annual meeting of the North Carolina Academy of Science was held at Wake Forest College, Wake Forest, N. C., on May 6 and 7, 1932, with 215 members and visitors registered at the meeting. Papers were presented before the general section of the academy on the first day. In the evening the retiring president, F. A. Wolf, professor of botany at Duke University, gave the presidential address on "An Old Botanical Puzzle" (tobacco frenching). On the second day the academy met in the following sections: general section, chemistry section, mathematics section and physics section. Seventy papers and ten exhibits were on the program. (Abstracts of most of these and complete papers of several will appear in an early number of the *Journal of the Elisha Mitchell Scientific Society*.)

Resolutions of respect were passed in honor of two deceased members, William Willard Ashe, senior forest inspector in "Region 7" of the U. S. Forest Service, a charter member of the academy; and of Mary Frances Seymour, professor of biology at Catawba College.

The academy celebrated its thirty years of active service by electing to life membership those charter members now on its roll. These members are C. S. Brimley, zoologist with the North Carolina Department of Agriculture; H. H. Brimley, curator of the State Museum; W. L. Poteat, president emeritus and professor of biology at Wake Forest College; Franklin Sherman, Jr., professor of entomology at Clemson College; and H. V. Wilson, professor of zoology at the University of North Carolina. The academy also elected to life membership C. W. Stiles, recently retired from the U. S. Public Health Service, who, though not a charter member of the academy, has held membership for many years while laboring so effectively for health improvement throughout the South. The executive committee reported the election of thirty-five active members during the year.

Miss Frances Katherine Faust, a student of the Greensboro Senior High School, was declared the winner of the high-school science prize, a silver loving-cup, for the best essay submitted by a high-school student. (Essays for 1932 were confined to the fields of chemistry and physics).

The officers elected for 1933 were:

GENERAL ACADEMY

President, J. B. Bullitt, University of North Carolina.
Vice-president, Earl H. Hall, North Carolina College.
Secretary-treasurer, H. R. Totten, University of North Carolina.
Executive Committee, the above officers; W. L. Porter, Davidson College; F. W. Sherwood, N. C. Agricultural Experiment Station; Charles M. Heck, State College.
Representative to the A. A. A. S., H. R. Totten, University of North Carolina.

CHEMISTRY SECTION

Chairman, F. W. Sherwood, N. C. Agricultural Experiment Station.
Vice-chairman, H. D. Crockford, University of North Carolina.
Secretary-treasurer, R. W. Bost, University of North Carolina.
Councilor, L. G. Willis, State College.
Executive Committee, L. A. Bigelow, Duke University; A. S. Wheeler, University of North Carolina; J. H. Saylor, Duke University.

MATHEMATICS SECTION

Chairman, J. M. Thomas, Duke University.
Secretary, Helen Barton, North Carolina College.

PHYSICS SECTION

Chairman, H. E. Fulcher, Davidson College.
Secretary, C. N. Warfield, North Carolina College.

The thirty-second annual meeting of the North Carolina Academy of Science will be held at Davidson College, Davidson, N. C., in the spring of 1933.

H. R. TOTTEN,
Secretary

SCIENTIFIC APPARATUS AND LABORATORY METHODS

CONTROL OF ULTRA-VIOLET RAY LAMPS

INVESTIGATIVE work with ultra-violet ray lamps is handicapped considerably by the difficulty in obtaining equal doses of irradiation during a time unit in serial experiments. Not only will irradiation provided by different lamps of the same make vary widely, but also the effect of one lamp at different times. For accurate experimental results it is therefore necessary to determine the irradiation power of the lamp frequently, if not before each experiment. A simple method of ultra-violet lamp control is employed in the writer's laboratory.

The iodized oil preparations which are in clinical use for roentgenographic contrast effect (in bronchography, etc.) are chemical compounds of vegetable oils and of a high percentage of iodine. The French preparation "Lipiodol" (Lafay) which we use is a compound chiefly of poppy-seed oil and 40 per cent. of iodine. Its content of free iodine seems to be quite constant at .03 mg per cc of Lipiodol. Under the influence of daylight additional iodine is freed slowly from the compound, while under irradiation with ultra-violet light the decomposition of the oil occurs with great swiftness, beginning after 35 seconds of irradiation. Determination of the free iodine content after irradiation over a given period furnishes an excellent indication of the power of the lamp at the moment. The following procedure of irradiation and of titration of free iodine is employed.

For practical purposes it is sufficient to employ one

TITRATION OF IRRADIATED LIPIODOL FOR FREE IODINE

Distance of ultra-violet lamp: 30 cm.

Lipiodol in Stender dish, layer 2½ mm.

Dissolve 2 cc of the irradiated Lipiodol in 10 cc CCl_4 (Carbon tetrachloride).

Add 10 cc of 10 per cent. KI (Potassium Iodide).

Acidify with HCl. Starch as indicator.

Titrate with 1/1000 N Sodium Thiosulphate ($Na_2S_2O_3$)

$$\text{Calculation: } \frac{\text{gms } Na_2S_2O_3}{\text{MW } Na_2S_2O_3} = \frac{X}{\text{MW } I_2}$$

X = gms I_2 freed from Lipiodol

EXAMPLE OF RESULTS

Amount of Lipiodol	Time of irradiation	cc 1/1000 N $Na_2S_2O_3$	mg Iodine per cc of Lipiodol
2 cc	15 sec.	.5	.032
2 "	35 "	.5	.032
2 "	1 min.	.9	.057
2 "	2 "	1.6	.101
2 "	3 "	2.0	.127
2 "	4 "	2.4	.152
2 "	5 "	2.5	.158
2 "	6 "	2.7	.171
2 "	7 "	3.6	.228
2 "	10 "	5.1	.323

irradiation period and, for instance, judge the power of the lamp by the free iodine content in the oil after five minutes' irradiation.

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CELLOPHANE AS A SUBSTITUTE FOR MICA

I AM taking this means of acquainting my fellow workers in the field of mineralogy and petrology with the uses I have made of cellophane. Any one who has attempted to make quarter-wave mica plates or to build up a mica wedge or to make a Bravais Test Plate is well acquainted with the difficulty encountered in obtaining plates of mica of the same thickness. I accidentally discovered that cellophane was doubly refractive and remarkably uniform in thickness. With this material I have made practically every kind of accessory for which mica is usually employed, with very little effort because of the abundance of the material. The usual accessories are rather expensive and schools and colleges can rarely afford to supply all their pupils with them. It would be perfectly possible and I believe would lead to a better understanding of the phenomena revealed if the pupils were taught to make their own accessories using this material.

WALTER E. HAMMOND

KEENE, NEW HAMPSHIRE

SPECIAL ARTICLES

HISTOLOGICAL BASIS OF SEX CHANGES IN THE AMERICAN OYSTER (OSTREA VIRGINICA)

IT has long been known[1] that the European oyster (*O. edulis*) is hermaphroditic, with more or less regularly alternating changes of sex during its lifetime. More recently the writer[2] found that in *O. lurida* on the coast of southern California similar changes of sexual phase occur in rhythmical sequence, following a preliminary male phase. In the latter species the gonads of young animals always contain both ovogonia and spermatogonia, but the female cells are delayed in their development until after the completion of the male phase. Following the discharge of most of the sperm the female phase is assumed, but before ovulation has occurred residual spermatogonia

[1] J. H. Orton, *Jour. Mar. Biol. Ass.*, 14: 967–1045, 1926–27.

[2] W. R. Coe, SCIENCE, 74: 247–249, 1931; *Bull. Scripps Inst. Oceanog., Tech. Ser.*, 3: 119–144, 1932.

which did not participate in spermatogenesis during the first male phase now engage in a rapid proliferation to form the gametes of the second male phase, which usually follows the female phase immediately. After a period of recuperation the animal again functions as a female and the sequence is repeated.

In *O. virginica,* on the other hand, the adults are, with few exceptions, of separate sexes. About a year ago Burkenroad[3] produced evidence to show that on the coast of Louisiana this species is regularly protandric. He concluded that all individuals in that region first become sexually mature as males and that with increase in size some of them change to the opposite sex. The proportion of these young males which will thus reverse their sex was thought to depend in some measure, at least, upon the location of the individual with reference to other and larger individuals. Those which are closely associated with others more frequently retain the male phase than do those which are widely separated, for the proportions of females among isolated individuals was found to be much greater than among those growing in clusters.

Quite recently Alfreda Needler[4] has shown that sex reversal actually occurs in the adult oyster, for one of the three males which survived her experiment was found to be of the opposite sex when examined the following year. The work of Amemiya[5] on the Japanese oyster (*O. gigas*) is thought to indicate that sex in that species is differentiated each winter without regard to the sexuality of the animal during the preceding year.

In order to determine, if possible, the histological explanation for the sexual conditions found in *O. virginica,* serial sections of the gonads of young oysters of approximately known age have been made at frequent intervals during their first two years of life.

The study shows that the early gonads in all individuals examined are histologically similar, containing both ovogonia and spermatogonia, but in widely different proportions. At the age of about four months, or when the shell has reached a length of about 12 to 20 mm, the young ovocytes become conspicuous by their rapid growth and the presence of deeply staining mitochondrial bodies (yolk nuclei). Synapsis and spireme-formation precede the growth stages. In the same follicles, and interspersed among the ovocytes, are much greater numbers of spermatogonia in rapid proliferation, leading to the formation of the primary spermatocytes in which synapsis and spireme-formation likewise occur.

As the temperature of the water becomes lower, toward the end of November in Long Island Sound and on the south shore of Long Island, the growth of the ovocytes is inhibited and the proliferation of spermatogonia ceases. During the winter months there is but little change in the appearance of the gonads, but activity is resumed in early spring unless the nutritive conditions of the individual are retarded.

At this season sexual differentiation occurs in many of the larger individuals. The character of the gonads then changes, either by the continued proliferation of spermatogonia and the formation of spermatocytes, as is more usual, or by the rapid growth of the ovocytes in the small proportion of animals that are to become functional females during their first year. In the former case many of the previously formed ovocytes gradually become pycnotic and eventually disintegrate, although large numbers of indifferent gonia and usually some ovocytes remain as residual cells after spermatogenesis has been completed. In such residual cells lies the prospective potency of a later sex reversal.

A much smaller number of the young oysters, however, during the past season in the areas under investigation, became functional females during their first year. In the gonads of these most of the spermatocytes became pycnotic and eventually disintegrated during the process of ovogenesis, although usually some spermatocytes remained as residual cells.

Not infrequently during this process of sexual differentiation different follicles in the same gonad showed opposite sexual characteristics and in some cases true hermaphroditism continued into the breeding season. The eggs of such individuals appear to develop normally after self-fertilization in spite of the vast excess of sperm with which they are surrounded.

The samples examined indicate that in New Haven harbor less than 3 per cent. of the oysters that become sexually mature during their first year are females, while at West Sayville, Long Island, where they reach a much larger size at the age of one year, the percentage of females is between 20 and 30. The ovaries of these develop directly from the primary intersexual gonad without passing through a true preliminary male phase. The species is thus only partially protandric, and it is conceivable that the more numerous males may include both genetically "true males" and protandric males.

Sex changes in this and possibly in other species of seasonably dioecious oysters are evidently based upon the essential hermaphroditism of the primitive gonads and the retention of residual cells of different sex potencies in the individual at the end of the breeding season. And since, as a rule, only the largest of the oysters develop as females during their first

[3] M. D. Burkenroad, SCIENCE, 74: 71–72, 1931.

[4] Alfreda B. Needler, *Cont. Can. Biol. and Fish.,* 7: 285–294, 1932.

[5] I. Amemiya, *Proc. Imp. Acad. Tokyo,* 5: 284–286, 1929.

year, with a much larger proportion of females where the nutritive conditions are better or extend over a longer period, as indicated by the size attained during the first year, it is assumed that the sexuality of the animal is closely correlated with its nutrition. The observation that males are more frequent among closely clustered groups than among isolated individuals may likewise be indicative merely of different nutritive conditions at the critical period of sex differentiation, and is not considered proof that the early male phase is retained because of the hormonic influence of a neighboring individual.

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AUTOLYZED LIVER THERAPY IN PERNICIOUS ANEMIA

FRESH beef liver from slaughter house was ground and $\frac{1}{50}$ Normal HCl added in the proportion of 2,000 gms minced liver to 5,000 cc $\frac{1}{50}$ Normal HCl. Chloroform was added as a preservative. This mixture was placed in an incubator at 37° C. and allowed to undergo autolysis for an average period of 10 days. Portions of this autolyzed liver preparation after partial concentration under reduced pressure were fed by mouth to 3 otherwise untreated cases of pernicious anemia, showing classical clinical features with symptoms indicating cord changes, typical blood picture and achlorhydria. Reticulocyte responses characteristic of the treatment of pernicious anemia with potent material varying from 10 to 16 per cent. followed the oral ingestion of the equivalent of 500, 750 and 800 grams of liver, respectively, in the three cases studied.

The following figures summarize the finding in Case II of the reticulocyte response to autolyzed liver.

Date	Reticulocytes per cent.	Grams autolyzed liver fed
June 3, 1932	1.0	60
4	.5	150
5	2.0	300
6	1.0	300
7	1.5	
8	3.0	
9	7.0	
10	13.0	
11	9.0	

Riddle and Sturgis[1] report that the equivalent of approximately 3,000 grams of liver when fed in single massive doses by mouth in the form of Lilly's Extract No. 343 was required to induce a maximal reticulocyte response.

A comparison of the amounts of liver reported in the literature necessary to invoke a maximal reticulocyte response with the amounts of liver used above suggest that autolysis may increase the potency of the liver preparation.

This is of interest in relation to the recently reported findings of the influence of gastric juice and extracts of stomach on beef and liver.

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A NEW METHOD FOR THE DEMONSTRATION OF ANTIGEN-ANTIBODY COMBINATION

THE method for demonstration of antigen-antibody interaction is as follows:

A rabbit sensitized to some animal protein (blood serum, egg albumin, etc.), receives an intradermal injection of 0.25 cc of undiluted bacterial filtrate of ascertained skin-preparatory potency.[1] Twenty-four hours later the rabbit is injected intravenously with the same animal protein. From four to five hours later there appears severe hemorrhagic necrosis at the prepared skin site. The lesion is characteristic of the phenomenon of local skin reactivity to bacterial filtrates[2].

Inasmuch as the necessary state of sensitization can be obtained by a single injection of a protein and one-week incubation period is sufficient, the method offers the advantages of speed and simplicity. The readings are reliable and clear-cut, since the incidence of positive results is high (*i.e.*, with some proteins about 85 per cent. of rabbits tested after a single sensitization) and since the severe hemorrhagic necrosis makes the reaction unmistakable. The test is highly sensitive (*i.e.*, dilution 1:10.000 of human serum elicited the necessary sensitization) and strictly specific unless repeated sensitizing injections are made. Because anaphylactic shock in rabbits is difficult to elicit, the test injection of animal protein has no lethal effect on these animals.

It is also possible to elicit a severe reaction in prepared skin sites of non-sensitized rabbits receiving separate (one half hour apart) intravenous injections of antigen and antibody (*i.e.*, passive transfer).

The test is to be clearly differentiated from the

[1] Matthew C. Riddle and Cyrus C. Sturgis, *Am. J. Med. Science*, Vol. 180, page 1, July, 1930.

[1] G. Shwartzman, Proc. Soc. Exp. Biol. and Med., 26, 843, 1929; *J. Inf. Dis.*, 44, 232, 1929.

[2] G. Shwartzman, *J. Exp. Med.*, 48, 247, 1928.

Arthus phenomenon in view of the following important features: (1) Single sensitization is sufficient; (2) the reaction is obtained when rabbits are not ready as yet for the Arthus phenomenon; (3) the skin preparation with certain potent bacterial filtrates[3] is essential—inflammatory substances are incapable of eliciting the preparation; (4) the reaction is limited to the prepared skin site; (5) the antigen-antibody combination has to take place in the blood stream.

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SYRINGOPHILUS BI-PECTINATUS A QUILL MITE OF POULTRY[1]

DURING the summer of 1930, five chickens were presented for examination which showed a condition not previously observed at this laboratory. These fowls were presented with the following history and symptoms: A peculiar molt in the flock had been noticed for about one year. The loss of feathers involved over half of the body in most cases, and in many all the feathers were lost. About 75 per cent. of a flock of 1,500 birds were affected with this condition. Aside from the loss of feathers, the birds were apparently in good physical condition.

When the birds were examined, it was found that many stumps of quills remained and had the appearance of being broken. The interior of the quill contained a yellowish-gray or brownish powder, in place of the normal white transparent pith. This material was examined with the aid of a microscope and found to contain a large number of mites which were identified as the *Syringophilus bi-pectinatus*.

This mite was first reported by Heller,[2] who found them in the quills of chickens and pigeons. He stated that up to 90 per cent. of all the chickens of the province Schleswig-Holstein that were examined by him were found to be parasitized. Norner[3] presented a thesis on this mite in which he gave a detailed description of the parasite, together with methods of preservation and staining. The only report of the finding of this mite in the United States is by Hancock.[4] He found it on the feathers of the black flycatcher (*Phoenopepla nitus*) and described it as a new species, *Picobia villosa*. Trouessart[5] claimed that this supposedly new species was actually identical with *Syringophilus bi-pectinatus* Heller. In the same year (1895) Hancock accepted the view that his species was the *Syringophilus bi-pectinatus*.

Since September, 1930, this mite has been found in five widely separated flocks of chickens in Ohio. It has also been found in the turkey and the golden pheasant.

This mite has an oval body provided with numerous stripes and furrows, which run both horizontally and longitudinally. They are parallel to each other and consist of a thickening of the epidermis. The posterior end is rounded. The head is long, especially in females. On each side of the head, lying close to it, is a palpus. The mature mites have eight legs, the first two pairs lying close to the head, the other two behind the middle of the body. The legs are armed with numerous bristles; toward the end there are two short hooklets, bearing two pectinate (comb-shaped) chitinous structures. This double comb is characteristic for this mite and is the reason Heller chose the name *bi-pectinatus*. The body is divided into three segments, a head, thorax and abdomen.

The female mite may attain a length of 0.74 to 0.84 mm; a width of 0.16 to 0.2 mm. The length of the male is 0.56 to 0.6 m; the width is 0.17 to 0.19 mm. The nymphs reach a length of 0.3 to 0.5 mm. and a width of 0.13 to 0.15 mm. The larvae have a length of 0.23 to 0.31 mm. and a width of 0.09 to 0.13 mm. The average length of the ova is 0.26 mm. and their average width is 0.16 mm; the ova taper toward the poles.

Trouessart[6] states that this mite enters the quill at its upper umbilicus, which remains widely open during the whole period of development and is not closed until the quill is fused to the shaft. The mite makes its exit from the inferior umbilicus after death and desiccation of the feather.

R. E. REBRASSIER
E. D. MARTIN

[3] G. Shwartzman, *J. Exp. Med.*, 51, 571, 1930.

[1] The College of Veterinary Medicine, The Ohio State University, in cooperation with the Ohio Agricultural Experiment Station, Reynoldsburg, Ohio.

[2] A. Heller, "Die Federspulmiben die Schmarotzer," pp. 186–188. 1880.

[3] C. Norner, "Syringophilus bi-pectinatus," Oesterr Vierteljahrssch. f. wiss. Veterinarkunde," 57: 91–148, 1882.

[4] Joseph L. Hancock, *The American Naturalist*, 29, 382–384 and 866–867, 1895.

[5] E. L. Trouessart, *The American Naturalist*, 29: 682–684, 1895.

[6] E. L. Trouessart, "Sur les Acariens qui vivent dans le tuyau des plumes des Oiseaux," Comptes Rendus de l'Acad. des Sciences, p. 1130, 1884.

BOOKS RECEIVED

DIETRICH, HAROLD G. and ERWIN B. KELSEY. *Laboratory Manual to accompany Introductory General Chemistry.* Pp. x + 158 + 73. Illustrated. Macmillan. $1.00.

FALKENHAGEN, HANS. *Elektrolyte.* Pp. xvi + 345. 104 figures. S. Hirzel, Leipzig.

FELT, E. P. and W. H. RANKIN. *Insects and Diseases of Ornamental Trees and Shrubs.* Pp. xix + 507. 243 figures. Macmillan. $5.00.

PIEPER, CHARLES J., WILBUR L. BEAUCHAMP and ORLIN D. FRANK. *Everyday Problems in Biology.* Pp. xxxiii + 686. 475 figures. Scott, Foresman. $1.60.